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ASSEMBLY — 40TH SESSION

TECHNICAL COMMISSION

Agenda Item 30: Other issues to be considered by the Technical Commission

NEXT GENERATION NOPS

(Presented by the United Arab Emirates)

EXECUTIVE SUMMARY	
This paper presents the Uunited Arab Emirates' plans to utilise big data, virtualisation and artificial intelligence for the operation of the United Arab Emirates' Network Operation Centre (NOC).	
Strategic Objectives:	This paper relates to Strategic Objectives defined in ICAO Business Plan 2017 – 2019: • Increased Air Navigation Capacity • Optimized the performance of the Global Aviation System • Improved Data, Analysis and Forecasting
Financial implications:	NIL
References:	Doc 9750, *Global Air Navigation Plan* (GANP) 2016 Edition

1. INTRODUCTION

1.1 The fifth edition of the *Global Air Navigation Plan* (GANP, Doc 9750) describes network operations as a series of processes to manage flows or groups of flights to improve overall traffic fluidity in a large or complex airspace containing multiple airports and multiple flight information regions (FIRs). In other words, network operations (NOPS) is an art of arranging air traffic flow smoothly inside a network and integrate it with adjacent or regional traffic flows.

1.2 Given its significant impact on the economy, establishment of a network management concept within a region requires strong political and legal support. To overcome the challenges of authority while making decisions, the NOPS unit shall have the necessary legal authorization. It is imperative to have a robust funding mechanism for NOPS' smooth operation. The principles of equity and transparency shall be woven into all of its processes, i.e. all airspace shall be treated the same and shall have the same access to decision making processes. Each stakeholder shall be able to view the situation of the network at any given time. The United Arab Emirates Airspace Restructuring Project completed on 7 December 2017 is a good example of a similar arrangement.

2. DISCUSSION

2.1 Activities of NOPS start in the strategic phase where the activities related to the changes in the national resources such as airspace and airports are well planned and coordinated to complement each other and they are carried out either for the improvement of a current situation or to ensure the service continuity. A good NOPS build on collaborative decision-making (CDM) among stakeholders in real time, including national security agencies, to take advantage of more advanced system capabilities and adopt user preferences to assist air traffic flow management (ATFM), as detailed in Doc 9971, *Manual on Collaborative Air Traffic Flow Management*, in making the most efficient use of airspace resources on an equitable basis. The Concept of Operations framework shall be in such a way that the sovereignty of each stakeholder is maintained throughout the process, and shall give each stakeholder a sense of ownership.

2.2 Savings in both capacity and delay costs can be achieved by better aligning capacity with demand. This requires seamless airspace design, improved prediction of traffic as well as the possibility to flexibly adjust capacity to match demand.

2.3 Principles of big data with necessary data check points for systems or procedures shall be instated from the planning phase of NOPS and shall continue throughout its operations. According to International Data Corporation (IDC) only 33 per cent of data will be in a usable form by 2020 and we analyse and utilize less than 0.5 per cent of the data that exists, but the industry and governments are increasing their investment in research to aid in marketing, healthcare, security, decision-making and entertainment. In aviation, this can be translated to efficient flights. To enable this, the items captured as part of big data shall have the required granularity for NOPS to drill down through a specific resource and to present its findings in real-time for continuous improvement of the network. Examples of data captures may be:

a) the actions of all users for a specific flight, on a specific day, at a specific time of the day, departing from a specific airport and flying through a specific route,

b) the performance of a specific flight, on a specific day, at a specific time of the day, departing from a specific airport and flying through a specific route; and

c) the planned usage and actual usage of a resource such as sector plans, runway usage.

2.4 The analysis based on this data is a continuous process and shall be supported by computer systems that can handle a variety of data in high volumes and pace. Its accessibility, and flexibility for customization is of utmost importance. The outcome of each analysis helps the authorities and managers to make better and faster decisions.

2.5 Because of the nature of the data produced and the number of users that will be using it to make their day-to-day operational decisions, it shall be planned to use distributed system working on the basis of virtualization. The decision from the information produced by NOPS contributes to safety. An efficient NOPS contributes not only to a higher efficiency, but also contributes to the safety of air traffic by preventing traffic overload and excessive workload. Nevertheless, the unavailability of NOPS operation can still be managed safely at the cost of efficiency as the NOPS mission is not safety-critical. For this reason, it shall be considered to host NOPS data on a cloud based facility. Such an arrangement makes the access easier, and the whole subject of information technology (IT) security for the data shall become the responsibility of the cloud provider. The cloud provider shall also ensure the availability of the service taking into consideration of all IT hardware requirements.

2.6 In the modern world of high-speed internet and specialized virtualized applications, having a virtualized set up for NOPS that is utilizing the latest collaboration tools such as web-ex and IP Phony, any stakeholder, from any part of the world, at any time can join the NOPS decision-making process. This may be as part of a routine process in normal circumstances or an ad hoc process during disruptions.

2.7 Sheikh Zayed Air Navigation Centre systems produce close to four million surveillance reports over a 24 hour period, which is equal to 1 600 reports on an average per flight. The flight time within United Arab Emirates airspace varies from 8 to 42 minutes. The number of interactions by air traffic control (ATC) system users or sub-systems are 130 000 per day, which translates to 52 interactions on an average per flight. Such an amount of data is a great opportunity for computer systems to identify patterns and trends. Once such patterns have been extracted, the systems can learn and improve its learning to further pin-point the behaviour. Adding artificial intelligence (AI) to this equation will turn out to be a game changer. Utilizing the Internet of Things (IoT) such as closed-circuit television (CCTV) footages and environment microphones will be an advantage to this scenario, where user's response to environmental effects can also be captured.

2.8 To take full advantage of this information-rich environment, as well as of enhanced aircraft position information the AI systems will be able to predict accurately the trajectory of each flight taking into consideration all unique characteristics for that flight including all interactions by involved stakeholders. The AI system will also predict the resource (airspace and aerodrome) usages. The stakeholder or NOPS operators will only have to confirm the AI systems' prediction. The prediction is then executed. The difference between the prediction and what actually took place as well as the preferences made by operators can be learnt by the AI system and taken into consideration for the next set of predictions.

2.9 Supporting the notion of trajectory-based operations and relying on the provision of air navigation services in support of the execution of the business or mission trajectory — meaning that aircraft can fly their preferred trajectories without being constrained by airspace configurations. As this process reaches an acceptable level of maturity and confidence, the prediction can be shared with external NOPS or ATFM Units, supporting the vision of trajectory-based operations that is facilitated by digital technologies and enabled by a free-route airspace implementation. This information is then shared with other stakeholders through system wide information management (SWIM) platforms. The resultant trajectory will allow the external units to accurately predict their role with regards to this flight. This will also contribute to free-route operations (FRTO), flexible use of airspace (FUA), continuous climb operations (CCO) and continuous descend operations (CDO) leading to the most efficient flight for each aircraft whilst accommodating all stakeholder preferences.

2.10 This process is repeated throughout the year, while the AI systems continue to learn in the background and improving the entire air traffic situation scenarios at each iteration, allowing the benefit to be reaped by the entire aviation community by being part of the NOPS.

3. CONCLUSION

3.1 The Assembly is invited to:

a) note the information contained in this paper; and

b) consider, if possible, the incorporation of big data, virtualization and artificial intelligence in their development and modernization plans.

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